

APPLICATION FOR LETTERS PATENT OF THE
UNITED STATES OF AMERICA

For the invention entitled:

MOBILE REFRIGERATOR WITH REPORTING SYSTEM

Inventor:

MARC LAJEUNESSE

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Mobile Refrigerator with Reporting System

FIELD OF THE INVENTION

This invention relates to the field of mobile refrigeration systems for Emergency Medical Service (EMS) vehicles and other vehicles requiring a cooling capability and a reporting system to record performance parameters in real time.

BACKGROUND OF THE INVENTION

Formerly, ambulances were manned by minimally trained crews with the ultimate goal of getting the patient to a hospital or emergency room as quickly as possible. The vehicles were equipped with very basic equipment, such as back-boards, tourniquets and pressure bandages.

It has become standard practice, in most jurisdictions, to provide emergency medical treatment and rescue through Emergency Medical Service (EMS) with highly trained crews and appropriately equipped vehicles. The vehicles now used for EMS are much more sophisticated than the mere transportation formerly available. The vehicles carry resuscitators, intravenous solution kits, including blood plasma and whole blood, and pharmaceuticals in solid and liquid form. The

1 vehicles also include electrical devices for cardiac
2 treatment, for gathering and recording medical data from the
3 patient, such as blood pressure, pulse rate,
4 electrocardiogram, and pulmonary data, among other things.

5 Some of the solutions and pharmaceuticals carried on EMS
6 vehicles are time and temperature sensitive. Also, some of
7 the drugs carried in the vehicles are controlled substances
8 and must be used by authorized personnel. Usually, such
9 items are stored at a base facility and loaded on a vehicle
10 for a specific emergency.

11 Other vehicles are now being used for investigations or
12 research that require a permanent record of the activities,
13 inventories, and parameters of collected items. For example,
14 vehicles used to investigate crime scenes require records to
15 establish chain of custody, as well as, the conditions of the
16 items in custody. Research vehicles, in general, have use
17 for devices that can be used to control temperature and make
18 a historical record of the contents in the vehicle.

19 Regardless of the specific activity to which the vehicle
20 is dedicated, all the equipment must be operated from the
21 electrical system of the vehicle or from batteries carried
22 with each item of electrical equipment.

1 DESCRIPTION OF THE PRIOR ART

2 U. S. Patent No. 5,572,873 issued to Lavigne et al
3 teaches an insulated carrier apparatus for storing
4 pharmaceuticals. The portable carrier apparatus is battery
5 operated and connected to a Peltier effect thermocouple or
6 thermopile for controlling the temperature inside the
7 carrier, with the temperature control calling for heat or
8 cold as the temperature fluctuates. An audible alarm is
9 activated upon a low voltage battery condition. The
10 apparatus includes a memory chip to record the temperature
11 range in the carrier and the time out of desired parameters.
12 The memory chip also records the opening and closing of the
13 door of the carrier.

14 In addition, the carrier apparatus can provide patient
15 medical status and parameters, in printed form, for review of
16 medical personnel at a receiving facility. The printed form
17 may include pharmaceuticals administered to the patient, if
18 properly entered in the memory by key pad.

19 The entire apparatus is self contained and may be
20 carried by an ambulance on an emergency mission. Otherwise,
21 it is connected to a standard electrical circuit.

22 U. S. Patent No. 5,809,785 issued to Polkinghorne
23 teaches a Peltier thermoelectric refrigeration drive assembly
24 for a compact refrigerator for use in recreational vehicles,

1 marine vessels, ambulances and delivery vehicles. The device
2 has at least two refrigerated compartments with the ability
3 to maintain different temperatures in each compartment.

4 U. S. Patent No. 6,082,799 issued to Marek teaches a
5 mobile ambulatory surgery center on a vehicle chassis. The
6 vehicle includes a refrigerator.

7 WIPO Publication No. WO 00/17585 published March 30,
8 2000 teaches a micro compressor for use in refrigerating
9 systems. The micro compressor is suited for portable
10 temperature control systems, as disclosed here.

11 What is needed is an integrated vehicular mounted system
12 having a secure compartment with an independent refrigerator
13 and heater for temperature control and a recording system to
14 provide historical data concerning the use and contents of
15 the compartment.

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18 SUMMARY OF THE INVENTION

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20 Accordingly, it is an objective of the instant invention
21 to teach a temperature controlled compartment having a secure
22 door which records openings and closings, as well as, door
23 ajar and door open times.

24 It is a further objective of the instant invention to

1 teach electronically controlling the temperature in a
2 vehicular compartment by a compressor driven refrigeration
3 unit and by use of electric resistance heat.

4 It is yet another objective of the instant invention to
5 teach an electronic soft start program for the compressor.

6 It is a still further objective of the invention to
7 teach running the compartment on a 12 volt electrical system.

8 It is another objective of the instant invention to
9 teach the use of a printer to log date, time and temperature
10 when the refrigerator or heater is activated.

11 It is another objective of the invention to teach a
12 vehicular mounted visual electronic continuous indicator of
13 the temperature in the compartment and a circuit that is
14 temperature sensitive to sound an alarm when the temperature
15 is out of limits.

16 Other objects and advantages of this invention will
17 become apparent from the following description taken in
18 conjunction with the accompanying drawings wherein are set
19 forth, by way of illustration and example, certain
20 embodiments of this invention. The drawings constitute a
21 part of this specification and include exemplary embodiments
22 of the present invention and illustrate various objects and
23 features thereof.

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1 BRIEF DESCRIPTION OF THE FIGURES

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3 FIG. 1 is a partial cut-away of a vehicle having the
4 temperature controlled compartment of this invention
5 installed therein;

6 FIG. 2 is a schematic of the computer control of this
7 invention;

8 FIG. 3 is a perspective of the temperature controlled
9 storage container of this invention; and

10 FIG. 4 is a perspective of the interior of the
11 temperature controlled compartment.
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14 DETAILED DESCRIPTION OF THE INVENTION
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16 The vehicle 10, shown in FIG. 1, may be an EMS
17 ambulance, or a crime scene mobile laboratory or a mobile
18 scientific laboratory. Other vehicles, such as RV's and
19 campers, or long distance trucks may carry the temperature
20 controlled compartment.

21 The vehicle 10 has all the basic components of a motor
22 vehicle including a chassis, wheels, motor driving the
23 wheels, transmission, (not shown) and an electrical system 11
24 powered by a battery. Steering apparatus is controlled by

1 steering wheel 15.

2 In FIG. 1, the driver's compartment or cab 12 has
3 access doors 13 and 14. A dashboard or instrument panel 16
4 has the standard vehicle instruments providing the driver
5 with visual information concerning the parameters of the
6 operation of the vehicle components. These instruments may
7 be analog or digital or a combination. Also present in the
8 cab 12 is an temperature gauge 17 indicating the temperature
9 in the temperature controlled compartment 18. The gauge 17
10 is located on the instrument panel, as illustrated, but may
11 be mounted at other locations visible to the crew. The
12 vehicle horn 19 can be connected, through the electrical
13 system, to the temperature sensor or gauge 17 to sound an
14 aural alarm when the temperature in the compartment is
15 outside the programmed range of acceptable temperatures.

16 The rear portion of the vehicle is arranged to receive a
17 patient Gurney 20 and EMS personnel seats 21 and 22. A work
18 space in the form of a counter top 23 is above the
19 temperature controlled compartment 18. A swing out printer
20 and CRT monitor 24 is provided for viewing a selection of
21 vital signs of the patient. Storage cabinets are above the
22 counter top 23 and can be located to the rear of the Gurney.
23 A sink and refuse tank combination 25 provides a source of
24 water. Also illustrated, is a stored collapsed folding wheel

1 chair 26. The entire rear of the vehicle is enclosed and has
2 large opening doors 27.

3 The instruments providing vital signs (not shown), the
4 printer and electronic monitor 24 and the refrigerator 18 are
5 integrated into the electrical system of the vehicle 10 for
6 electrical power. The vehicle may be equipped with an
7 external power plug and transformer (not shown) for
8 connection to a standard electrical outlet when the vehicle
9 is not in service.

10 FIG. 2 shows a schematic of the computer chip 28 used
11 to operate the refrigerator and alarms. As shown, the
12 computer may be wired into the vehicle electrical system 11.
13 The computer chip is available on the market, for example,
14 under the name, "PICSTIC". The computer controller 28
15 incorporates digital inputs and outputs, analog inputs, real-
16 time monitoring, power-input regulation, and serial
17 communication in a single module. The operating voltage may
18 be from 5 volts to 24 volts DC and will operate at the
19 conventional 12 volt vehicle system. The computer 29 is a
20 low-cost CMOS fully-static 8 bit micro-controller with 1KB x
21 14 EEPROM program memory and 64 bytes of EEPROM data memory.
22 The controller manages the temperature controlled compartment
23 through 12 volt relays 30 and 31 to the compressor 32 of the
24 mechanical refrigerator system and the resistance coils of

1 the electric heaters 33.

2 The electric heaters 33 are mounted in the walls of the
3 temperature controlled compartment to provide radiant heat to
4 the interior. The compressor/condenser/evaporator is also
5 mounted on a wall of the compartment to provide cooling air
6 to the interior of the compartment. The evaporator is vented
7 to the ambient atmosphere, by fan, through the vehicle wall.
8 The overall size of the under counter space is approximately
9 18 inches depth, 20 inches height, and 17.75 inches width for
10 a compartment having an interior space of 2 cubic feet. The
11 weight of this unit is approximately 25 pounds. For an
12 interior space of approximately 4 cubic feet, the overall
13 compartment space is approximately 26.625 inches depth, 20.5
14 inches height, and 17.75 inches width with an approximate
15 weight of 45 pounds. The temperature controlled compartment
16 may be made in various sizes and the above dimensions are
17 merely representative.

18 With this computer, the desired temperature can be set
19 for practically any range. Also, a log can be kept to show
20 the date, time, and temperature every time the cooling or
21 heating units come on-line. The computer can track the date,
22 time and temperature of instances in which the temperature is
23 out of the specified range and the duration of such
24 instances. A printer option can make a written record of

1 these parameters. The programming includes a "soft start"
2 program that facilitates initiation of cooling or heating
3 without a surge in the system. The controller will send a
4 signal to the gauge 17 every second. The computer also has a
5 data port for connection to download and upload information
6 to other computers, such as another on-board computer or
7 archive.

8 As an example, some pharmaceutical manufacturers
9 recommend that optimal temperatures for some drugs is between
10 59 and 86 degrees F. The computer may be programmed to
11 initiate heating at 61 degrees F and cooling at 83 degrees F.
12 The limit for each separate system may be set at 70 degrees
13 F.

14 Another modification of the temperature controlled
15 compartment includes an electrical connection through the
16 door latch to the computer. This permits a record of every
17 time, date and temperature that the door latch is operated
18 and the duration of time the door is not latched. The
19 printer may make a written record of this information for
20 future use. This sub-system is desirable if the compartment
21 is used to store controlled substance drugs and/or other
22 materials requiring a record of their possession and
23 parameters of storage.

24 FIG. 3 shows a similar system having all the features

1 and dimensions, as described above, without being integrally
2 installed in a vehicle. This controlled temperature storage
3 container 58 may be connected to a vehicle electrical system
4 through a power cord with cigarette lighter adapter. The
5 mechanical refrigeration system is mounted on an end wall 59
6 and the evaporator is vented through grills 60. This allows
7 the device to be used without ventilation to ambient
8 atmosphere. As shown, the container has a top loading door
9 61 and door latches 62. This unit permits continuous storage
10 of temperature sensitive materials at a permanent site
11 without drawing on a vehicle's battery. This simplifies
12 record keeping and un-necessary handling of the contents when
13 the vehicle is not used for prolonged periods of time.

14 The interior of the device is shown in FIG. 4. The
15 door, side walls, bottom and top of the temperature
16 controlled compartment have insulation 63 for assisting in
17 maintaining interior temperature. The vent 64 connects the
18 refrigeration system to the interior space. The temperature
19 sensor 65 is mounted on an interior wall. As shown, whole
20 blood bags 66 are stored in the interior.

21 It is to be understood that while a certain form of the
22 invention is illustrated, it is not to be limited to the
23 specific form or arrangement of parts herein described and
24 shown. It will be apparent to those skilled in the art that

1 various changes may be made without departing from the scope
2 of the invention and the invention is not to be considered
3 limited to what is shown and described in the specification
4 and drawings.

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